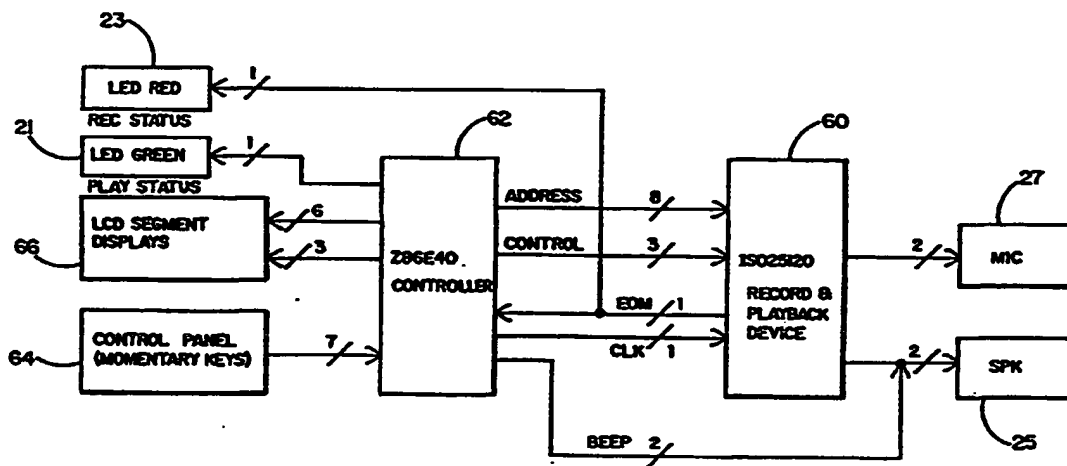




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(54) Title: CREDIT CARD SIZE AUDIO RECORD AND PLAYBACK DEVICE



## (57) Abstract

An audio recording and playback device (60) has a microphone (27) and speaker (25) to enable input and output, respectively. The user is able to control input and output functions using a control panel (64). Displays (23, 21 and 66) are utilized to inform and verify the user's selection of desired functions.

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**CREDIT CARD SIZE AUDIO RECORD  
AND PLAYBACK DEVICE**

**FIELD OF THE INVENTION**

The present invention relates generally to a solid-state device for recording and playing back audio information, and more specifically to a credit card size device which can be used for recording and playing back voice and other audio information of at least two minutes in duration and without requiring any external devices such as power supplies, tape, recorders or the like.

## BACKGROUND ART

Ever since the advent of audio recording tape, there has been a continuing evolutionary process directed toward a reduction in the size of audio recorders. However, because of the requirement for moving an audio storage tape across a fixed recording or playback head, even the smallest of audio tape recorders requires a motor and at least one battery which prevent miniaturization beyond a minimum limit. Consequently, even with the tremendous advances in miniaturization of electronics over the last decade, audio recorders have remained relatively fixed in their level of ultimate miniaturization. Attempts to use solid-state memory devices to record audio information digitally, while doing away with the requirement for moving parts and the power requirements associated therewith, have run into another road block, namely, the requirement for mass amounts of memory capacity to store any significant period of information for later playback. However, a relatively recent innovation disclosed in U.S. Patent No. 4,989,179 assigned to Information Storage Devices, Inc. of Santa Clara, California has created a breakthrough in the art related to analog

signal recording and playback. This patent discloses the use of an integrated circuit having an array of non-volatile memory cells to store audio signal information in analog form and to retrieve it on a real-time basis. Further development of this integrated circuit since the issuance of that patent has produced a family of devices, offering single chip record/playback durations of up to 120 seconds with telephone quality voice reproduction.

The present invention is designed to exploit this new breakthrough in analog signal recording technology by providing a consumer product in the form of a credit card size package which has all the necessary user selective controls for recording and playing back at least two minutes of voice messages or other analog audio information. A product of that kind is believed to have numerous applications, including the attachment of such credit card size record/playback devices, to for example, a plurality of documents to provide the recipient thereof with a brief audio message describing the content, nature or purpose of those documents and the reason they have been sent. In other words, the present invention may be considered an audio replacement for the written Post-it note, manufactured

by the 3M company. However, the present invention, in its preferred embodiment, opens up a new consumer product field, namely the communication of brief audio messages in a package that is so small and inexpensive that it may be readily mailed or shipped in a configuration which may be readily operated by the recipient who need only press a button to hear an audio message and who need not supply a separate recorder or player to facilitate such communication.

There is no prior art known to the applicant which is capable of providing that function in such miniature form. The closest known capability comparable to that of the present invention is found in miniature audio tapes. However, such tapes require that the sender and the user each retain an apparatus for first recording and subsequently playing back the shipped audio tape. On the other hand, the present invention is, in its preferred configuration, an all encompassing unit which is self-sufficient in that the sender records his message and sends the entire unit to the recipient who then plays the message back on the same unit. Because of its miniaturization characteristics, the unit adds virtually no weight to a package of documents. In any case, it may be shipped in a small envelope at

extremely low postage rates because of its correspondingly low weight. Furthermore, because the present invention is relatively inexpensive, low in volume and entirely self contained, it may be used as a memory source for archival message storage. For example, it may be used for storing cooking recipes, wherein each such credit card size audio analog recording device, provides a brief but ample length message which describes the recipe for a particular type of food or meal and which may be re-recorded with a new message many times. A user may gain access to such recipe simply by pressing a button which is labelled "play". There is simply no prior art known to the applicant which can accomplish this function in such a miniature configuration and without requiring a large investment in larger, more expensive record/playback devices.

The present invention may also be configured so that a user can only play back a recorded message without recording or erasing that message. Such a configuration may be readily implemented by providing only a "play" switch, recording being accomplished only by connecting a suitable electric connector to the device and thereby recording a preselected message

prior to public disbursement of the device. Such re-recordable, pre-recorded, play only configurations may have significant advantageous application in conjunction with on-site advertising and marketing of products available in retail stores.

Still another configuration using suction cups, may be readily affixed to cellular phones for conveniently storing audio messages such as phone numbers communicated to the user during phone conversations. The thin, lightweight implementation disclosed herein, makes it uniquely suited for that purpose without adding any significant bulk or weight to the cellular phone.



### SUMMARY OF THE INVENTION

The present invention comprises a credit card size record/playback apparatus which permits analog recording of audio information of at least two minutes in duration in a package configuration which is entirely self contained, requiring no external power supply or other electronic devices with which to operate. In one preferred embodiment disclosed herein, the apparatus of the present invention utilizes an ISD Model 25120 single chip record playback device manufactured by Information Storage Devices, under the trademark "DIRECT ANALOG STORAGE TECHNOLOGY" or "DAST". It also uses a CMOS based 8-bit microcomputer controlled micro-controller which provides timing and status signals, as well as control, responsive to manually operated push buttons to record and play back analog audio signals.

The present invention also comprises a suitable speaker and microphone which are both integrated into the credit card size package of the present invention for operation in the record and playback modes, respectively. In a preferred embodiment of the

invention herein disclosed, there is also provided liquid crystal displays for indicating time of day, day, alarm or event alert and message counter. Manually depressible switches are also provided for controlling the record and playback operations, message protection, as well as for searching and identifying different messages or message events contained in the recording, such as by scrolling either forward or backward through the stored messages from message to message or within a message. The preferred embodiment of the present invention also provides an optional, detachable clip-type appendage so that the credit card size recorder may be readily clipped to a document or to a shirt pocket or the like. In addition, a preferred embodiment employs a plurality of magnets built into the package, whereby the credit card size record/playback device of the present invention can be secured to any magnetic metal object, such as a filing cabinet or a refrigerator surface.

The present invention may also be configured so that a user can only play back a recorded message without recording or erasing that message. Such a configuration may be readily implemented by providing only a "play" switch, recording being accomplished only

by connecting a suitable electric connector to the device and thereby recording a preselected message prior to public disbursement of the device. Such pre-recorded, play only configurations may have significant advantageous application in conjunction with on-site advertising and marketing of products available in retail stores.

A suction cup version is contemplated for direct attachment to cellular phones for recording critical messages therefrom.

## OBJECTS OF THE INVENTION

It is therefore a principal object of the present invention to provide a miniature solid state audio signal record and playback apparatus which provides at least a minimum of two minutes of message recording and playback in a credit card size package that is entirely self contained and includes all necessary power, microphone, speaker and switching to accommodate such recording and playback.

It is another object of the present invention to provide a credit card size solid state analog signal recording and playback device, which may be used for storing voice messages, the packaging thereof being sufficiently small in size to make it conducive to attachment to documents and the like forming a transmission medium in the form of a voice recording to accompany such documents to explain the content thereof.

It is still an additional object of the present invention to provide an entirely self-contained solid state audio signal recording and playback device which is approximately the same size and shape as a standard credit card for permitting recording and playing back relatively brief audio messages of at least two minutes in length, such as for storing and relaying the content of a recipe upon the depression of a single push button switch and which because of its extremely low cost, can function in common business protocol, such as in the form of business cards, audio instruction device, document attached device description and the like.

It is still an additional object of the present invention to provide a miniature audio message re-recordable storage device in a credit card size configuration suitable for unique commercial application including on-site product advertising and the like.

**BRIEF DESCRIPTION OF THE DRAWINGS**

The aforementioned objects and advantages of the present invention, as well as additional objects and advantages thereof, will be more fully understood hereinafter as a result of a detailed description of a preferred embodiment when taken in conjunction with the following drawings in which:

FIG. 1 is a plan view of the front face of an audio signal record/playback device in accordance with the present invention;

FIG. 2 is a side view thereof;

FIG. 3 is an electrical block diagram thereof;

FIG. 4, comprising FIGs. 4a and 4b, is an electrical schematic diagram thereof;

FIG. 5, comprising FIGs. 5a, 5b, 5c, 5d and 5e is a flowchart diagram of software contained therein;

FIG. 6 is an isometric view of an alternative configuration of the present invention, utilizing a desktop device;

FIG. 7 is a side view of the device shown in FIG. 7;

FIG. 8 is a plan view of a voice card used in the desktop device of FIG. 6; and

FIG. 9 is an electrical block diagram of the desktop device shown in FIG. 6;

FIGs. 10 and 11 illustrate an embodiment suitable for connection directly to a cellular phone;

FIG. 12 is a "play-only" configured embodiment of the invention suitable for advertising and marketing applications; and

FIG. 13 is an exemplary illustration for advertising or marketing use of the embodiment of the invention shown in FIG. 12.

### DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

Referring now to FIGs. 1 and 2, it will be seen that a preferred embodiment 10 of the present invention comprises a recorder/player face 12 in a credit card size configuration of approximately 3.4 inches in width, 2.1 inches in height and no greater than 0.25 inches in depth. This configuration of the invention provides the following key features, master ON/OFF switch 18, play ("P") 20 and record ("R") 22 buttons, speaker 25, microphone 27, digital LCD clock 24, digital LCD display 32 of the day, a clock set button 26 and associated fast and slow forward buttons 30 and 28, a day set button 34 for associating an alarm time with a particular day, a message set button 38, an alarm button 29 and message set advance switch 40. A message protect switch 42 and a removable clip option 17. The master ON/OFF switch 18 may be left in the ON position most of the time, since the invention automatically powers down after playing or recording. The switch should be turned to the OFF position when protection from accidental power up is desired, such as in the situation where the product is sent in an envelope to a recipient. The play button 20 is a



momentary switch with a tactile feel that lightly clicks when pressed and released. This "soft" button initiates logic in the circuitry of a printed circuit board 16 which begins up to at least a two minute period of playing a previously recorded message or other audio input. Each time the play button is pressed and released, the recorded message begins again to completion. The record button 22 is identical to the play button in operation and feel, with the exception that the additional hard switch on the right side of the product, determines whether recording can occur. This message protect switch is actuated when the operator wishes to disable recording capability. Both play and record buttons have associated light emitting diodes 21 and 23, respectively, preferably of different colors which are lighted when the play or record operation is in process, respectively.

The speaker 25 may be a voice coil miniature speaker which operates as normal speakers do, such as those that are used in common audio equipment. The microphone 27 is an electret variety. Both the speaker and the microphone are low profile, quality miniature components which are clip on board configured, surface mount soldered or wired to the printed circuit board

16, behind the face 12 of the product 10. A piezo-acoustic generator may be used as both or either the speaker and the microphone elements. The digital LCD clock display 24 provides an indication of the time of day and whether it is AM or PM. The digital LCD display 32 of the day, indicates the day of the week. The clock set button 26 permits adjustment of the clock time by using the associated slow and fast forward buttons 30 and 28, while clock set 26 is depressed. The day set button 34 may be depressed for scrolling through the days of the week, until the desired day is displayed. An alarm button 29 may be used in conjunction with the clock to set an alarm time. It may also be used with the day set button for setting an alarm day. The message set button 38 may be depressed for associating a particular alarm time and day to a particular message, such as for example, in message/alarms for advising the user of the time for taking certain medications. The alarm can be configured to either alert the user to push "play" in response to an audible sound or LED light or simply begin the playing of a selected message

(i.e., "take your medication") at a preselected time. The four switches 46, 48, 50 and 52 below the play button 20 are, observing them from left to right in FIG. 1, respectively, for reverse, increment reverse, increment forward, and forward. The reverse switch 46 may be used to skip to a previous message. The increment reverse switch 48 may be used to scroll through a particular message. The increment forward switch 50 may be used to scroll forward through a particular message and the forward switch 52 may be used to skip to the next subsequent message in storage. Clear button 44 may be used to erase the entire set of messages or a selected message when used with the record button 22.

A wide plastic or metal clip 17 may be provided to facilitate easy connection of the invention to a group of papers, such as in intercompany mail or for explanatory notes associated with various documents to which the invention is attached. The clip 17 may also be used to attach the product to another surface, such as the visor above an automobile windshield. The clip 17 is preferably removable and when removed, leaves a flat backside surface. A plurality of magnets (not shown) may be provided on the backside surface 14, one

in each corner thereof, flush mounted so that the invention can be attached to metal surfaces, such as a file cabinet or refrigerator door.

As seen best in FIG. 2, the audio signal storage device of the present invention comprises a front face 12, and a rear face 14. The faces 12 and 14 are separated by a printed circuit board 16. Furthermore, as seen in FIG. 1, the printed circuit board 16 provides a pair of battery terminals 54 and 56, which within the preferred embodiment hereof, comprise plus and minus terminals for receiving two 3-volt thin lithium batteries (not shown) connected in series to provide a 6-volt power source for the invention.

A block diagram of the present invention is shown in FIG. 3. As seen therein, the invention comprises two principal integrated circuit devices, namely an ISD25120 record and playback device and a Z86E40 controller. The record and playback device may be best understood by referring to a publication of Information Storage Devices, Inc. dated October, 1992 and entitled ISD2000 Family, Single-chip Voice Record/Playback devices, 60-120 Second Single-chip Durations. The model Z86E40 controller may be best understood by

referring to the Zilog product specification entitled Z86E40 CMOS Z80TPCCP micro-controller in the Zilog 1991 publication entitled Zilog microcontrollers, beginning at page 487 thereof. As seen in FIG. 3, the record and playback device 63 is connected to the controller 62 which supplies the address, control and clock signals thereto. The record and playback device 63 is connected directly to the microphone 27 and to the speaker 25. The controller 62 receives input signals from the control panel 64 of the front face 16, in the form of selected manual depression of the momentary keys described previously in conjunction with FIG. 1. The controller outputs signals to the LCD segment displays 66, as previously described in regard to FIG. 1. The red and green light emitting diodes 23 and 21 which display record and play status, respectively, are connected to the controller 62 as well.

The schematic diagram of the preferred embodiment of the invention shown herein is illustrated in FIG. 4, which comprises FIG. 4a and 4b. As seen in FIG. 4, the electronic circuit of the present invention comprises the aforementioned ISD25120 chip in its preferred embodiment, as well as the aforementioned Zilog Z86E40 controller chip. In addition, also shown in FIG. 4, is

an HD44780 LCD dot matrix display driver connected to the LCD dot matrix displays described beginning at page 114 of the Hitachi LCD Controller/Driver LSI Data Book. Also shown in FIG. 4 are the manual push button switches which control the operation of the invention as previously described in conjunction with FIG. 1. A plurality of such switches are shown in the circuit of FIG. 4, namely time set, event set, clock forward, alarm ON/OFF, reset, record, play, stop, play message, pause, forward, reverse, reset, scroll backward, scroll forward and repeat last.

The Z86E40 controller is a single chip architecture micro-controller with 4 kBYTES of EPROM memory and 236 BYTES of RAM housed in a 40 pin dual in-line package, manufactured in CMOS technology. It utilizes an eight bit micro-controller with an expanded register file to allow easy access to register map peripheral and I/O circuits. Thirty pins are dedicated to input and output functions. These lines are grouped into four ports, eight lines per port and are configurable for providing timing, status signals, and parallel input and output. There are four basic address spaces available to support various configurations. These are program, memory, data memory, register file and

expanded register file. The register file is composed of 236 BYTES of general purpose registers, four I/O port registers and 15 control and status registers. The expanded register file comprises three control resistors.

As shown in FIG. 4a, the controller is connected to an external parallel resonant and crystal, which in the preferred embodiment herein disclosed, is a 4.0 megahertz crystal for setting the clock rate of the controller at 1.0 megahertz. Each side of the crystal is in turn connected to electrical ground through a 22 F capacitor labelled C10 and C1, respectively.

The record and playback device is connected to a volume control resistor R4 at its speaker output terminals. R4 is a potentiometer-type resistor, the center tap for which is connected to an LM386 amplifier. The output of the amplifier is connected to a suitable speaker as previously described. The microphone output terminals of the record and playback device are connected through capacitors C4 and C5, to a suitable microphone, one terminal of which is connected through an RC network, consisting of resistors R5 and R6 and capacitors C7 to VCC the 6 volt supply. The AGC

terminal of the record and playback device is connected to an RC parallel network comprising resistor R7 and capacitor C6. The analog output and input terminals of the device are connected to a capacitor C9. VCC is a 6-volt supply derived from the two batteries shown in the upper right hand corner of FIG. 4b. Each battery provides three volts and the two batteries are connected in series with switch J4 which is the ON/OFF switch 18 shown in FIG. 1. A significant feature of the present invention is the extended battery life due to extremely low leakage current which provides virtually limitless non-volatile storage of audio and control signals. The various interconnections between the controller and the record and playback device include address signals for addressing the memory storage location in the record and playback device where messages are to be recorded or played back. Also provided in that interface are control signals for control of the record and playback device, including play and record as well as chip enable (CE), and end of message (EOM).



FIG. 5, comprising FIGs. 5a through 5e provides a logic flow chart of the message play/record and event planner operation of the invention. As shown therein after power on, the microcontroller initializes the message counter and address pointer, updates the LCD display of message count and loads address bits. Scan operations for a key contact (button depression) or event planner (alarm) time setting is then carried out. If a record key is depressed, the program in the microcontroller carries out the operations depicted in FIG. 5b. These operations include scanning for the stop key, turning on the timer, activating the record LED, displaying record time remaining and setting the control signals for activating record mode in the record and playback message storage device and activating other LED signalling functions such as low battery.

The stop key is continually monitored while message record time is simultaneously checked. When either the stop key is depressed or message time expires, control signals are reset, record LED is turned off, the timer is turned off and the remaining record time available is calculated. If the remaining record time is less than or equal to 3 seconds, the message count is

checked and either updated (if empty) or not updated (if not empty), the message display is updated accordingly and the next message address is loaded into a register in the microcontroller for subsequent operation. If more than 3 seconds of recording time remain, the message count is increased by one, a new message address (spaced one-half second from the newly recorded message end) is loaded into the appropriate register and the display is appropriately updated. In either case, the program returns to the key scan operation shown in FIG. 5a. The play, forward, reverse, scroll forward, scroll backward and repeat last operations are shown in FIG. 5c. In the play operation, the stop key is scanned, the play LED is turned on and the control signals for play operation of the record and playback message storage device are set until either the stop key is depressed or the EOM (end of message) bit is detected. In the latter case, the control signals are reset, the message count is advanced, the next message address is loaded into the register and the display is updated. In either event, the program returns to the key scan operation shown in FIG. 5a.

In each of the other forward and backward operations indicated in FIG. 5c, all keys are deselected, message count registers and display are adjusted appropriately (i.e., full message increment or decrement or 2 second increment or decrement of message address). Then the program returns to key scan. In the repeat last operation, the keys are deselected, the message count is checked to determine if it is greater than one and if it is the previous message count is fetched, addresses and display are updated and the program returns to the play operation to replay the previous message.

The pause operation and clear message operation are shown in FIG. 5d. In the pause operation, all keys except stop are deselected, the current message count is stored, the address of the current location is calculated and stored, control bits for the operation mode and enable status of the record and playback message storage device are set, the timer is turned on to assess elapsed time and the pause key is set and checked continuously. If either the pause key is no longer depressed, or the elapsed time exceeds 10 seconds, or the stop key is depressed, control bits are set, the timer is turned off and the program returns to

key scan operation. Otherwise, the elapsed time and pause key continue to be checked. In the clear message operation, all keys are deselected, message count and message address register are cleared and the program returns to key scan in FIG. 5a. If none of the aforementioned key operations is detected, the program eventually turns off the power automatically as seen at the bottom of FIG. 5d.

FIG. 5e depicts the operations for the alarm (event planner) feature of the embodiment of the invention shown in FIGs. 1-4. If the select event planner operation is selected, the program deselects all keys and sets the time and date, message count and alarm. It then checks for alarm on and if it's on, it beeps (sends beep tone to the speaker and waits for the beep to be turned off by the user. When that occurs, the program loads the message count and registers with appropriate addresses for the planned message, scans for stop and turns play mode on. Unless stop is depressed, the program carries out the play operation shown in FIG. 5c. If stop is depressed, the program returns to the initializing step in FIG. 5a.

An alternative embodiment of the invention is shown in FIGs. 6 through 9. Unlike the embodiment of FIGs. 1 through 4, the embodiment of FIGs. 6 through 9 is not designed for self-contained use, in that each card of the embodiment therein is designed to be installed in a console unit, the latter providing the speaker, microphone and control switches, in order to record and play back the contents of the analog storage device on the card. Accordingly, as shown in FIG. 6, 7 and 8, this alternate embodiment of the invention 70 comprises a console unit 72, into which two voice cards 74 and 76 are partially inserted. Console 72 is connected to a rear support member 73, which provides a convenient means for stable support of the console on a flat surface, such as a desk and the like. Rear member 73 may contain all or some of the electronics associated with the operation of the voice cards, including the batteries or alternating current conversion device which may be used with console 72.

As shown best in FIG. 6, console 72 provides a speaker 78, a microphone 80, a pair of control panels 82 and 84, one for control of each voice card and corresponding LED indicating lights 85 and 86. In addition, a volume control 88 is provided.

Furthermore, a record LED indicator 90 and 92 is provided for each of the voice cards. As shown in FIG. 7, each voice card 74 and 76 is inserted into a corresponding slot 75 and 77, respectively, within the console 72, where a plurality of contacts 94 on the voice cards are electrically connected to corresponding connectors 95, within the slots of the console 72. As shown in FIG. 8, the connectors 94 may be in a rectangular array as further delineated in FIG. 9. A plurality of reference arrows 98 provide the user with a clear indication of the direction in which the cards are installed in the console.

The electrical interconnections between the card 74 and 76 and the console 72 may be best understood by referring to the schematic block diagram of FIG. 9. As seen in FIG. 9, each voice card 74 and 76, comprises a record and playback analog signal storage device of the type hereinbefore described and a Zilog Z86E30 micro-controller, also of the type herein before described. In addition, it will be seen that the console 72, in addition to providing the speaker, amplifier, microphone and LED indicators previously described in conjunction with FIGs. 7 through 9, also provides a Zilog Z86E40 micro-controller 98 for controlling interface between the two cards, 74 and 76.

As seen further in FIG. 9, the control panel 82 provides manual switches for record, play, stop, pause, preview, next, scrolling forward, scrolling backward, message protection and selection of the A card or main card. A control panel 84 provides manual switches for copying, selecting the B card or backup card, playing, stop, pause, preview, next, scrolling forward and backward and message protection. Each of the manual switches on control panels 82 and 84 is applied as an input to the cards 74 and 76 through the contacts 94 on the cards 74, 76 and the connectors 95 in the console. The output of card 74, labelled speaker+ and speaker- in FIG. 9, is applied to a micro-controller controlled switch 99, which in one position, connects the output to the speakers 78 through volume control 88, through an amplifier 79. In the other position of switch 99, the output of the speaker terminals of main card 74, are applied to the microphone input connectors of backup card 76 and the output speaker terminals of card 76 are applied to switch 99, terminals A and B which are connected to the speaker 78 through the amplifier 79 and volume control 88.

Thus it will be seen that the console configuration shown in FIG. 9, is designed to record and playback messages on main card 74, as well as to copy the contents of the record and playback analog signal storage device on card 74, into the corresponding record and playback analog signal storage device on card 76. Alternatively, the console of FIG. 9 may be used to simply play the stored analog signals in card 74. This embodiment of the invention is deemed to be especially advantageous for use as a convenient communication and copying device where messages are transmitted on credit card size voice cards, such as cards 74 and 76. Each such card is thinner and lighter and less expensive than the embodiment of the invention shown in FIG. 1, because it contains only the two integrated circuit chips and the necessary contacts to interface with the console connectors and does not have to contain batteries, microphone, speaker or the other attendant features of the first embodiment of the invention. Thus for example, one may use the console 72 of FIG. 9 to create a short message of up to 2 minutes in duration, recording it on a voice card, such as card 74 and transmitting it by mail through interoffice or intraoffice delivery, where it may be inserted into another console 72 and played to



communicate a message stored therein and if desired, copied onto a backup card, such as card 76, by means of the console controls described in FIG. 9.

An embodiment of the invention especially suited for use on cellular phones for storing critical messages, is disclosed in FIGs. 10 and 11. As seen therein, a credit size message storage and playback device 120 is provided with a pair of suction cups 122 and edge-located record and play buttons 124 and 126, respectively and an on/off button 128. A speaker 130 and a microphone 132 are provided and a normal selection of control keys 134. One suction cup is located immediately above the microphone 132 and has an opening in it to permit sound pick-up from the back surface of a cellular phone 115.

Still another alternative embodiment of the present invention is shown in FIGs. 12 and 13. This embodiment may be considered an austere version of the embodiment of FIGs. 1 through 4, with a special modification for use in on-site marketing of products. Thus, the configuration of the invention shown in FIG. 12, is an entirely self-contained unit having battery power, as well as a speaker and play button, playing a recorded

analog audio message stored therein. However, while the embodiment of the invention shown in FIG. 12 has provision for storing messages, it is purposely devoid of any record button, so that messages stored therein cannot be erased, but only played. Recording of messages therein can be accomplished by connecting the card to a separate console, similar to the console of FIG. 9, wherein a microphone and record control permit entering a message to be stored in the card. Thus, the card 100 of FIG. 12, provides only a play button 102 and a speaker 104, and as seen in FIG. 13, is designed to be installed on a shelf beneath a corresponding product. Thus for example, in FIG. 13, it is seen that each card 100 is installed below a respective product, such as products 110, 112 and 114, respectively.

It will be apparent that the purpose of the embodiment of the present invention shown in FIGS. 12 and 13 is to provide a prospective purchaser of a product in a retail store, such as a supermarket or the like, with the opportunity to hear a message of short duration (up to approximately two minutes in duration, if desired), simply by pressing the play button on the card that is installed adjacent the product of interest. Each card 100 is preferably provided with an

adhesive backing, so that it may be readily installed on a shelf in the manner shown in FIG. 13. It will be understood that because of the relatively low cost of the present invention, it is economically feasible to provide such a card for virtually every product in a large retail store, such as a supermarket, so that the user may gain additional information at the time of purchase for selecting a particular product in a message of up to at least two minutes in duration. Such message may for example, describe the content of the product, its nutritional value, instructions on how to prepare the product, the relative advantages of the product over the competition's products of a similar nature, and other such information which may be instructional to the buyer or advantageous to the seller, whereby to convince a prospective purchaser to buy one product over another. Such play only embodiments may be used to provide audio instructions in a product package or serve as a business card and the like or as a toy, medical alert device or identification device for pets or personnel.

Having thus described preferred embodiments of the present invention herein, it will now be understood that the invention herein comprises a credit card size record/playback apparatus which permits analog recording of audio information of up to at least two minutes in duration in a package configuration which is entirely self-contained, requiring no external power supply or other electronic devices with which to operate. In one preferred embodiment of the present invention, a credit card size configuration comprises a suitable microphone and speaker which are both integrated into the credit card size package for operation in record and playback modes, respectively. A preferred embodiment of the present invention further provides liquid crystal displays for indicating time of day, date, and message count. Manually depressible switches are provided for controlling the record and playback operations, as well as for searching for and identifying different messages or message events contained in the recording, such as by scrolling either forward or backward through the stored messages, from message to message or within a particular message. The invention may also be configured so that a user can only play back a recorded message without recording over or erasing that message. Such a configuration may

be readily implemented by providing only a play switch, recording or re-recording being accomplished only by connecting a suitable electric connector to the device and thereby recording a preselected message prior to public disbursement of the device. Such prerecorded play only configurations may have significant advantageous applications in conjunction with on-site advertising and marketing of products available in retail stores. Still another configuration of the present invention disclosed herein, comprises a voice card version which has no speaker or microphone or batteries associated therewith, and which is operated in conjunction with a separate console unit, which may be used to create and play back messages, as well as to copy from one card onto another for archival purposes.

Those having ordinary skill in the art to which the present invention pertains, will now as a result of the applicants' teaching herein, perceive various modifications and additions which may be made to the invention. By way of example, the particular shape, size and configuration of the invention may be readily altered to virtually any configuration which can house the requisite components thereof. Thus for example, the present invention may be configured in other forms

where it can be used in a surreptitious manner if desired in a product configuration not normally recognizable as a record and playback device. Furthermore, the present invention may be configured for stacking a number of voice cards in an interconnected arrangement or cascading several record and playback circuit chips on one card whereby the total duration of recording is equal to the sum of the durations of the respective cards or chips, so that a record/playback apparatus having substantially greater message storage and playback capacity is implemented. Accordingly, all such modifications and additions are deemed to be within the scope of the invention, which is to be limited only by the claims appended hereto and their equivalents.

We claim:

## CLAIMS

1. An audio signal recording and playback apparatus comprising:
  - an analog signal integrated circuit storage device;
  - a microphone connected to said device;
  - an audio speaker connected to said device;
  - a source of electrical power connected to said device;
  - a micro-controller integrated circuit connected to said device for transmitting control and address signals to said device;
  - at least one manual switch connected to said micro-controller for generating at least one control signal for recording an audio signal in said device from said microphone and playing back an audio signal from said device through said speaker;
  - said device, said microphone, said speaker, said source, said micro-controller and said switch all being mounted on a common unitary printed circuit board.

2. The apparatus recited in claim 1 wherein said printed circuit board is less than about 2.5 inches by about 3.5 inches by about 0.25 inches.

3. The apparatus recited in claim 1 further comprising at least one manual switch connected to said micro-controller for generating at least one address signal for locating within said device a storage location for recording an audio signal and for playing back an audio signal at said location.

4. A solid-state analog audio signal storage and retrieval apparatus comprising:

means for storing an analog signal in an analog format;

means for controlling said storing means for establishing a recording mode for directing input analog signals to a selected memory location in said storing means; and for establishing a retrieving mode for directing stored analog signals at said selected memory location to an audio transducer; and



## Claim 4. continued

a signal-to-audio transducer for producing an audio sound corresponding to said stored analog signals;

said storing means, said controlling means and said transducer being configured in electrical interconnection on a common unitary circuit card.

5. The apparatus recited in claim 4 wherein said card is less than about 2.5 inches by about 3.5 inches by about 0.25 inches.

6. The apparatus recited in claim 4 further comprising at least one manual switch for activating said controlling means.

7. The apparatus recited in claim 4 further comprising an audio-to-signal transducer connected to said storing means for generating said input analog signals.

8. The apparatus recited in claim 4 further comprising display means for displaying a reference number associated with each said stored analog signal.

9. The apparatus recited in claim 4 further comprising a time of day clock and means for automatically initiating the production of audio sound from a selected stored analog signal upon a selected time of day.

10. A product description apparatus comprising:  
a credit-card size solid-state, audio message storage and playback device having an audio format product description stored therein;  
means for selectively activating said device for retrieving said audio format product description;  
means for audibly reproducing said retrieved audio format product description.

11. The product description apparatus recited in claim 10 further comprising means for affixing said apparatus adjacent to a product to be described.

12. An audio communication system comprising:

a first solid-state audio signal recording and playback apparatus having a first analog signal integrated circuit storage device, and a first micro-controller integrated circuit connected to said first device for transmitting control and address signals to said first device;

a second solid-state audio signal recording and playback apparatus having a second analog signal integrated circuit storage device, and a second micro-controller integrated circuit connected to said second device for transmitting control and address signals to said second device;

an electric console for receiving both said first and second recording and playback apparatus and having a microphone, a speaker, a plurality of manual switches for controlling each of said first and second recording and playback apparatus and a micro-controller-controlled switch for connecting said first device to either said speaker or to a microphone input of said second device for selectively switching between a mode for playing said first device into said speaker and a mode for playing said first device into said second device for copying audio messages from said first device into said second device.

13. A solid state message record and playback apparatus for storing audio information during conversations on a cellular phone; the apparatus comprising:

means for storing audio messages in analog form in a unitary integrated circuit device;

means for selectively retrieving said messages; and

means for affixing said apparatus to a surface on said cellular phone for detecting sound therefrom and storing said sound in the form of said audio messages for subsequent retrieval.

14. A solid-state audio signal storage and retrieval apparatus comprising:

means for storing said audio signal;

means for controlling said storing means for establishing a recording mode for directing input signals to a selected memory location in said storing means; and for establishing a retrieving mode for directing stored audio signals at said selected memory location to an audio transducer;

a signal-to-audio transducer for producing an audio sound corresponding to said stored audio signals; and

Claim 14. continued

a time of day clock having alarm means for generating an audible sound upon a selected time of day.

15. A solid-state audio signal storage and retrieval apparatus comprising:

means for storing said audio signal;

means for controlling said storing means for establishing a recording mode for directing input signals to a selected memory location in said storing means; and for establishing a retrieving mode for directing stored audio signals at said selected memory location to an audio transducer;

a signal-to-audio transducer for producing an audio sound corresponding to said stored audio signals; and

a time of day clock having alarm means for automatically initiating the production of audio sound from a selected stored audio signal upon a selected time of day.

16. The apparatus recited in claim 4 wherein said storing means provides at least up to two minutes of analog signal duration storage.

17. The apparatus recited in claim 4 further comprising a removable clip attached to said circuit card for attaching said apparatus to documents.

18. The apparatus recited in claim 4 further comprising at least one magnet attached to said circuit card for attaching said apparatus to a metal surface.

19. The apparatus recited in claim 4 wherein said storing means and said controlling means provide non-volatile analog signal and control signal storage, respectively.

20. A solid state analog signal record and playback device comprising:

an analog signal memory device;

a control signal generating device electrically connected to said memory device for establishing record and playback modes therein;

a play switch for activating said control signal generating device to retrieve an analog signal stored in said memory device;

a speaker connected to said memory device for producing an audible reproduction of said analog signal; and

at least one set of connectors electrically coupled to said memory device and said control signal generating device for receiving an analog signal to be stored in said memory device and for activating said control signal generating device for storing said analog signal in said memory device;

said memory device, said control signal generating device, said play switch, said speaker and said set of connectors being integrated on a card-shaped unitary housing having a maximum thickness which is no more than about 0.25 inches.

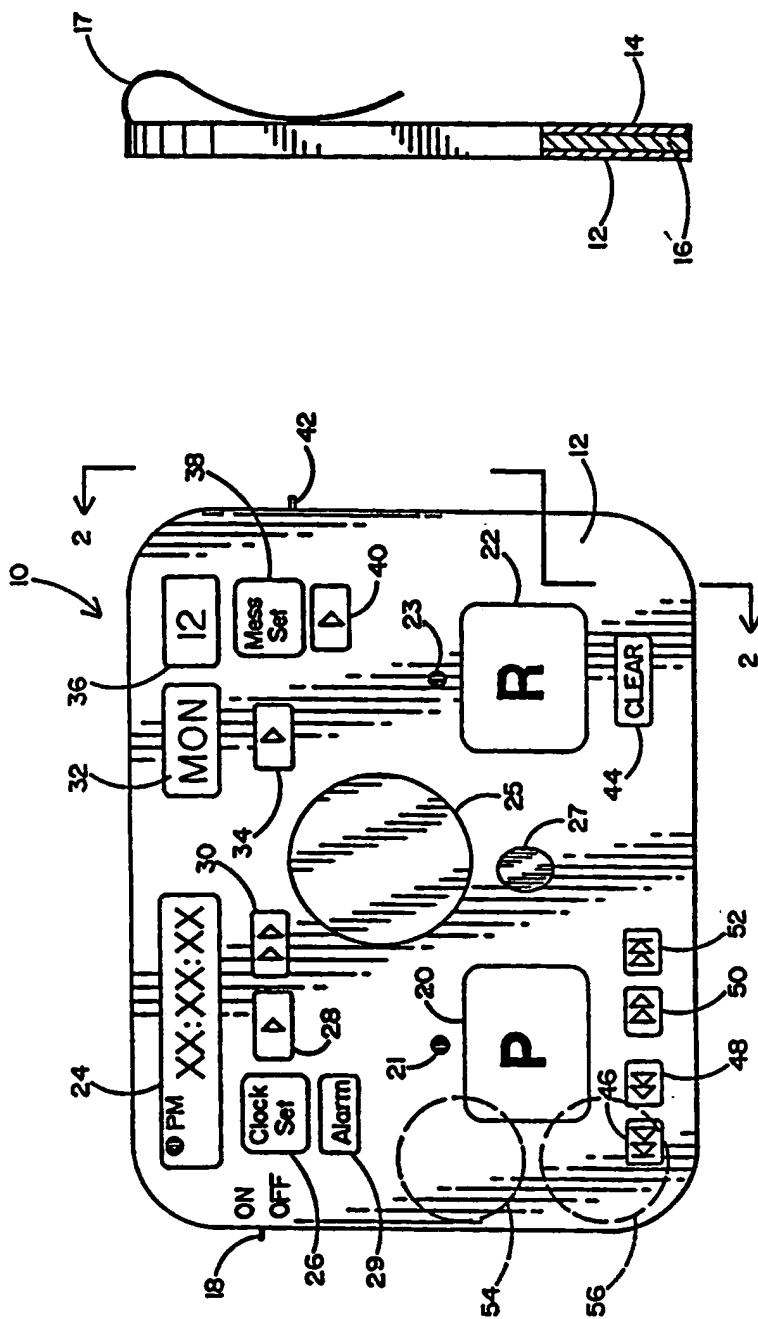


FIG. 2

FIG. 1



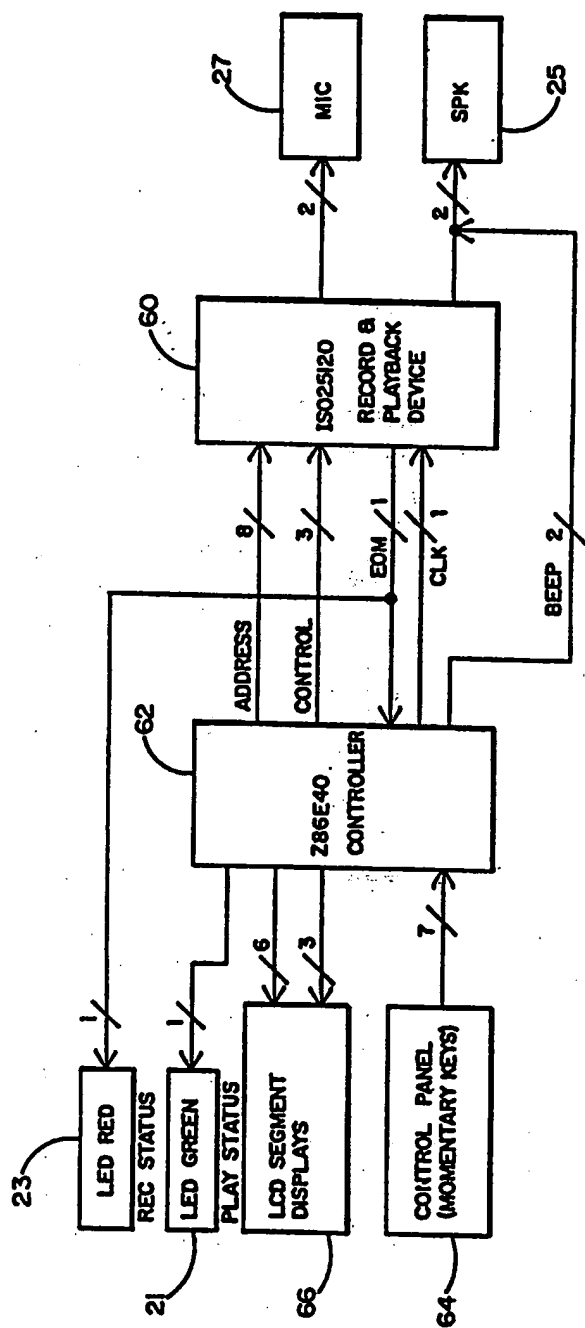


FIG. 3

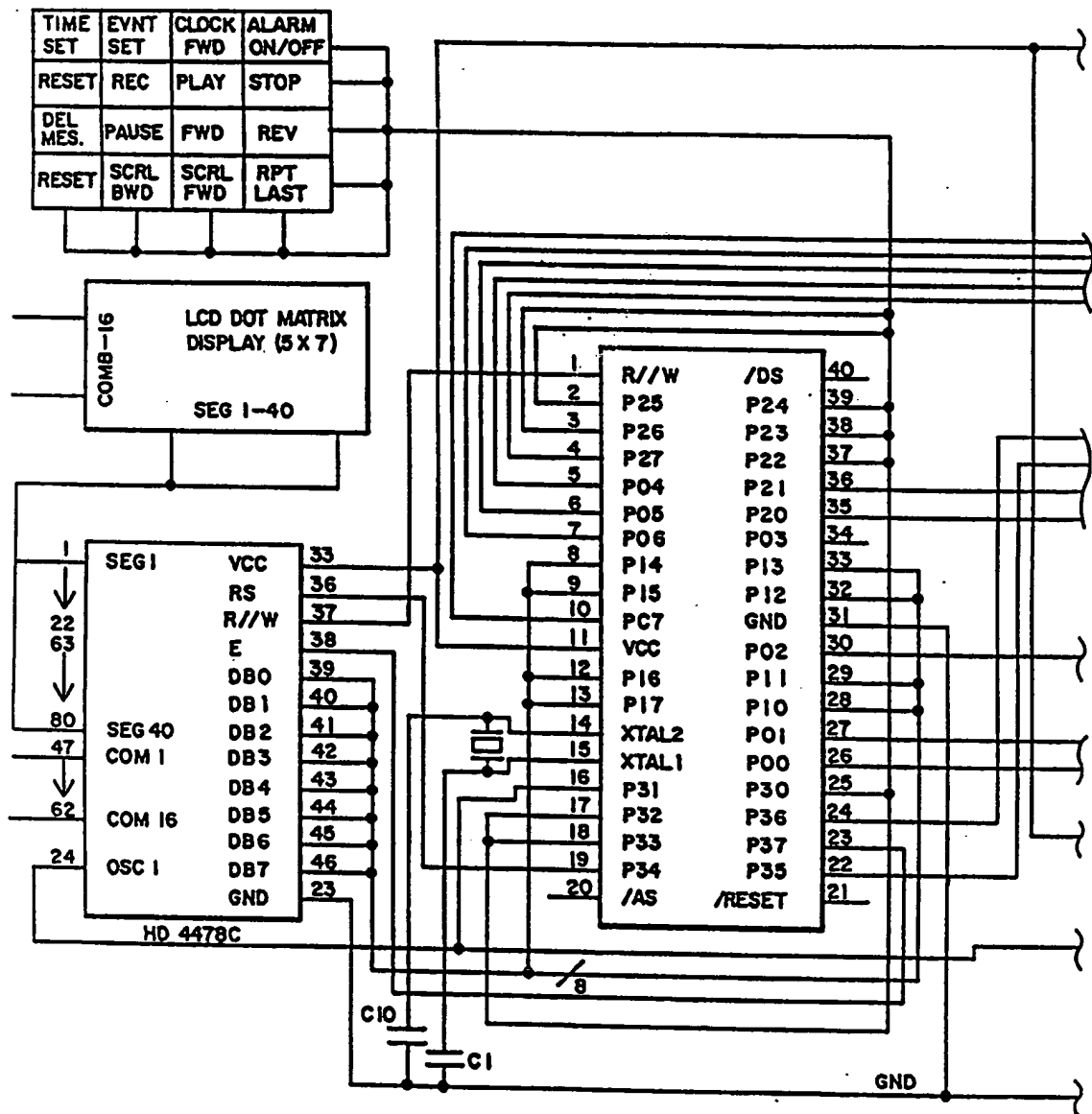


FIG. 4a

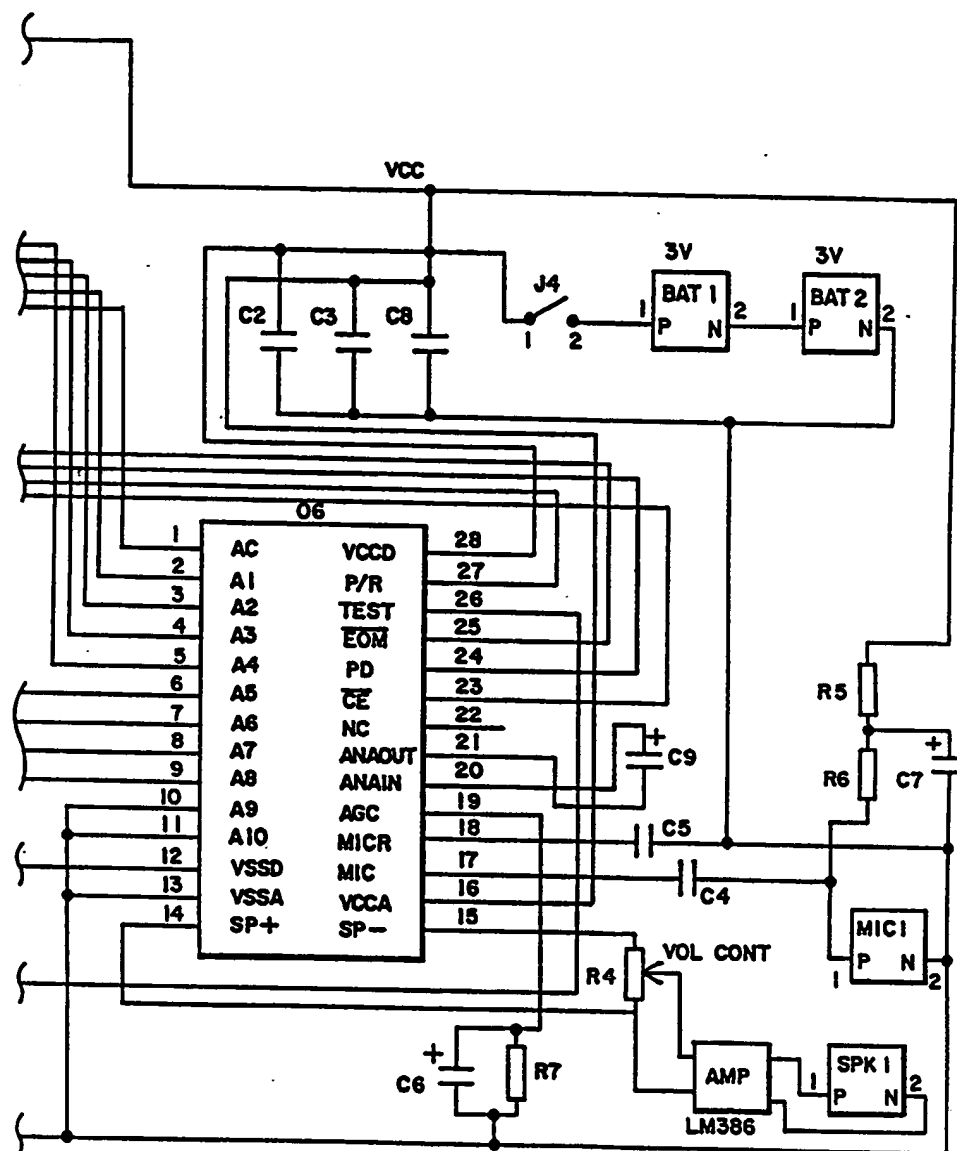


FIG. 4b

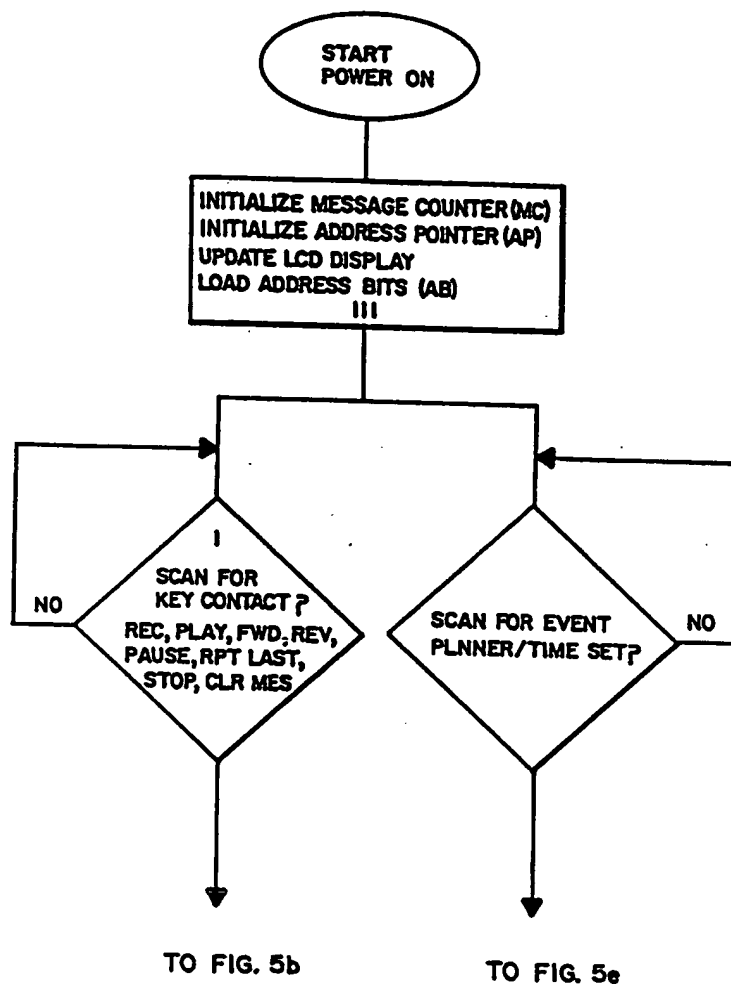


FIG. 5a

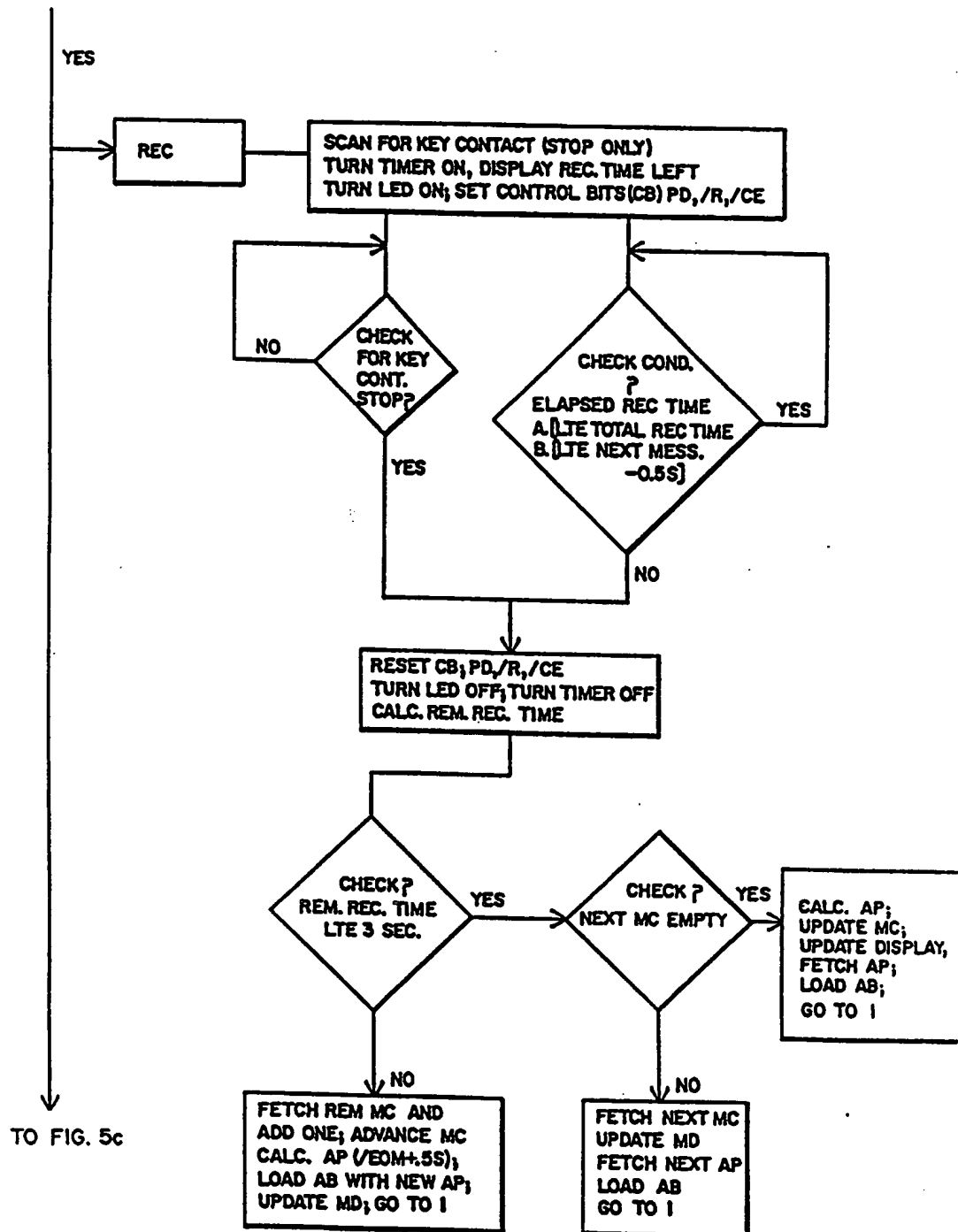
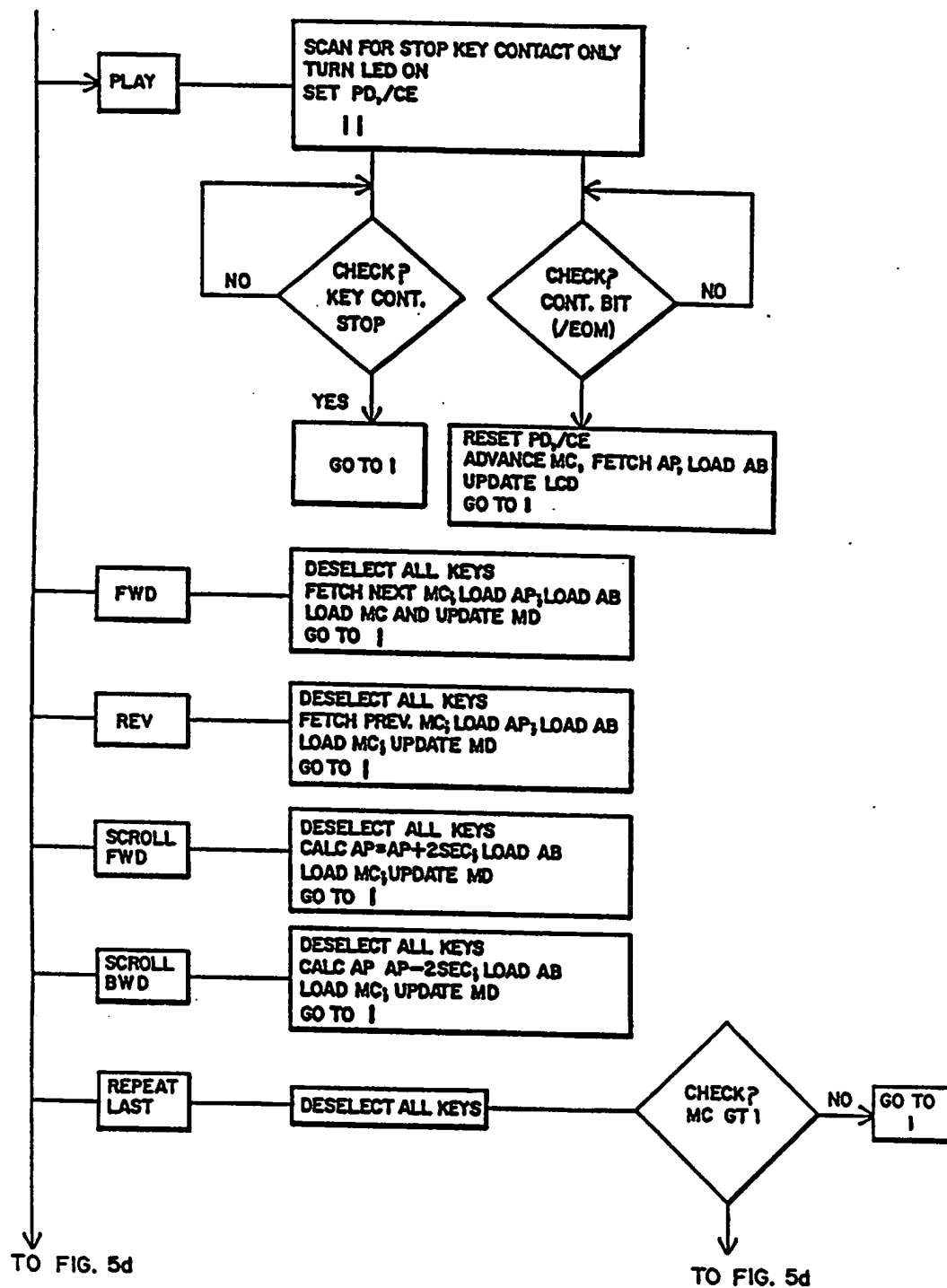


FIG. 5b

7/13



8/13

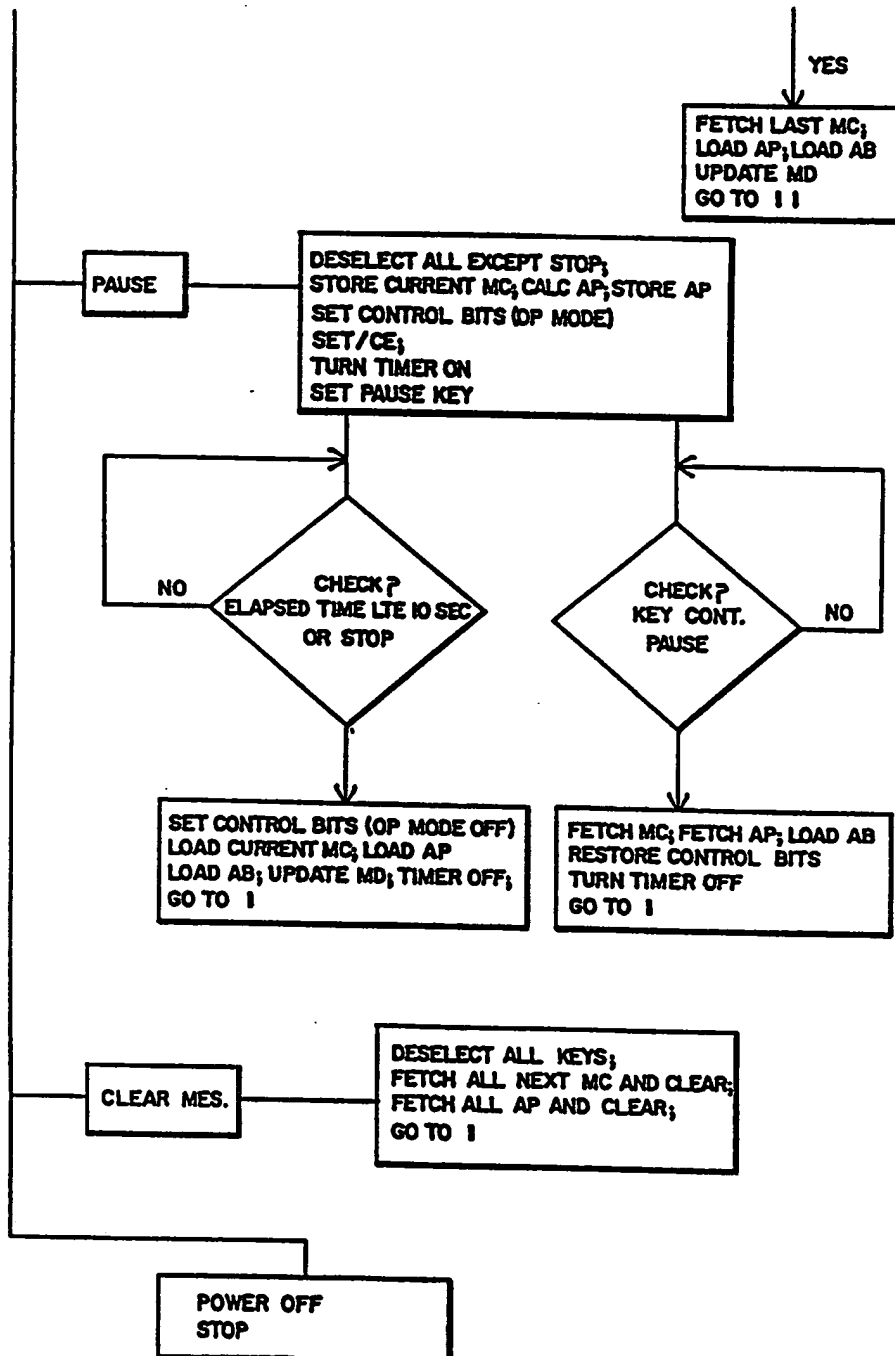


FIG. 5d

9/13

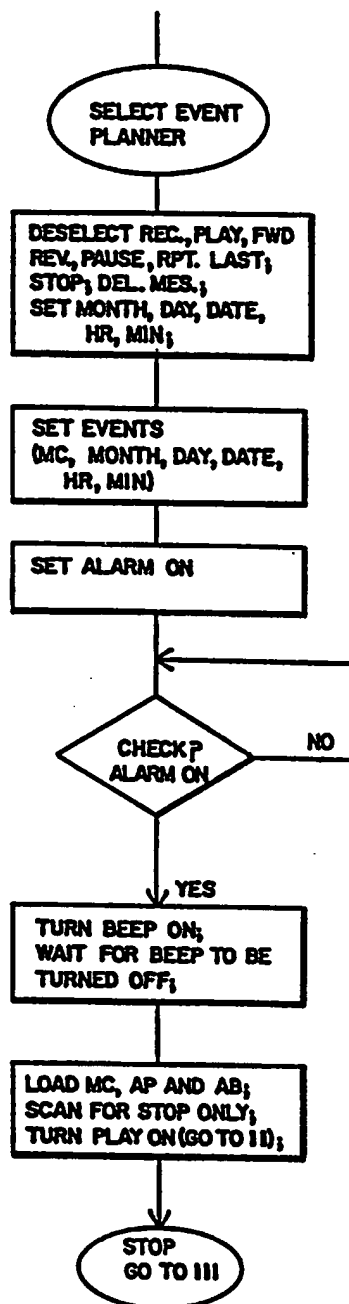


FIG. 5e



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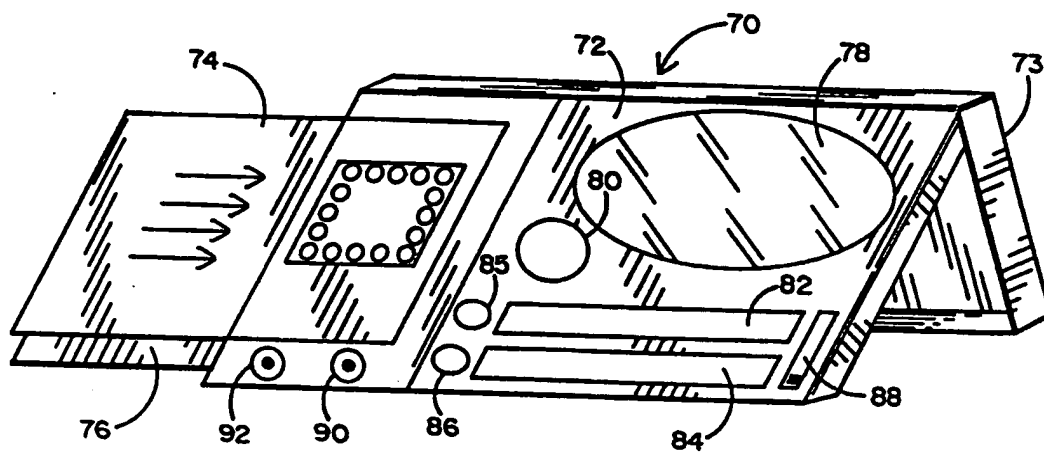


FIG. 6

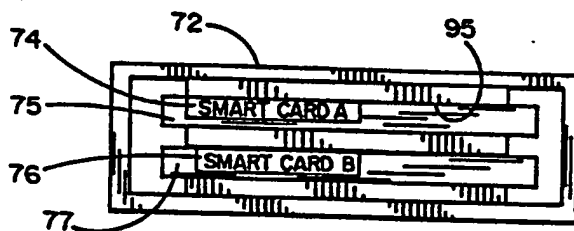


FIG. 7

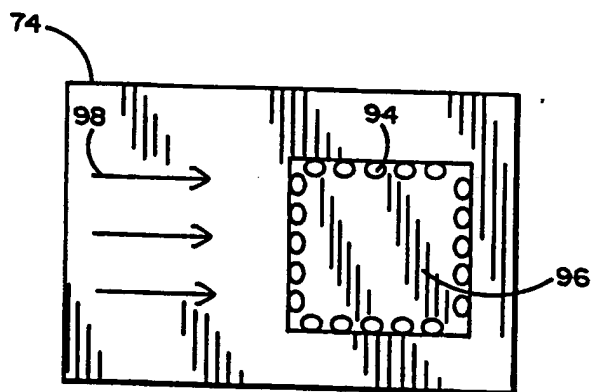


FIG. 8

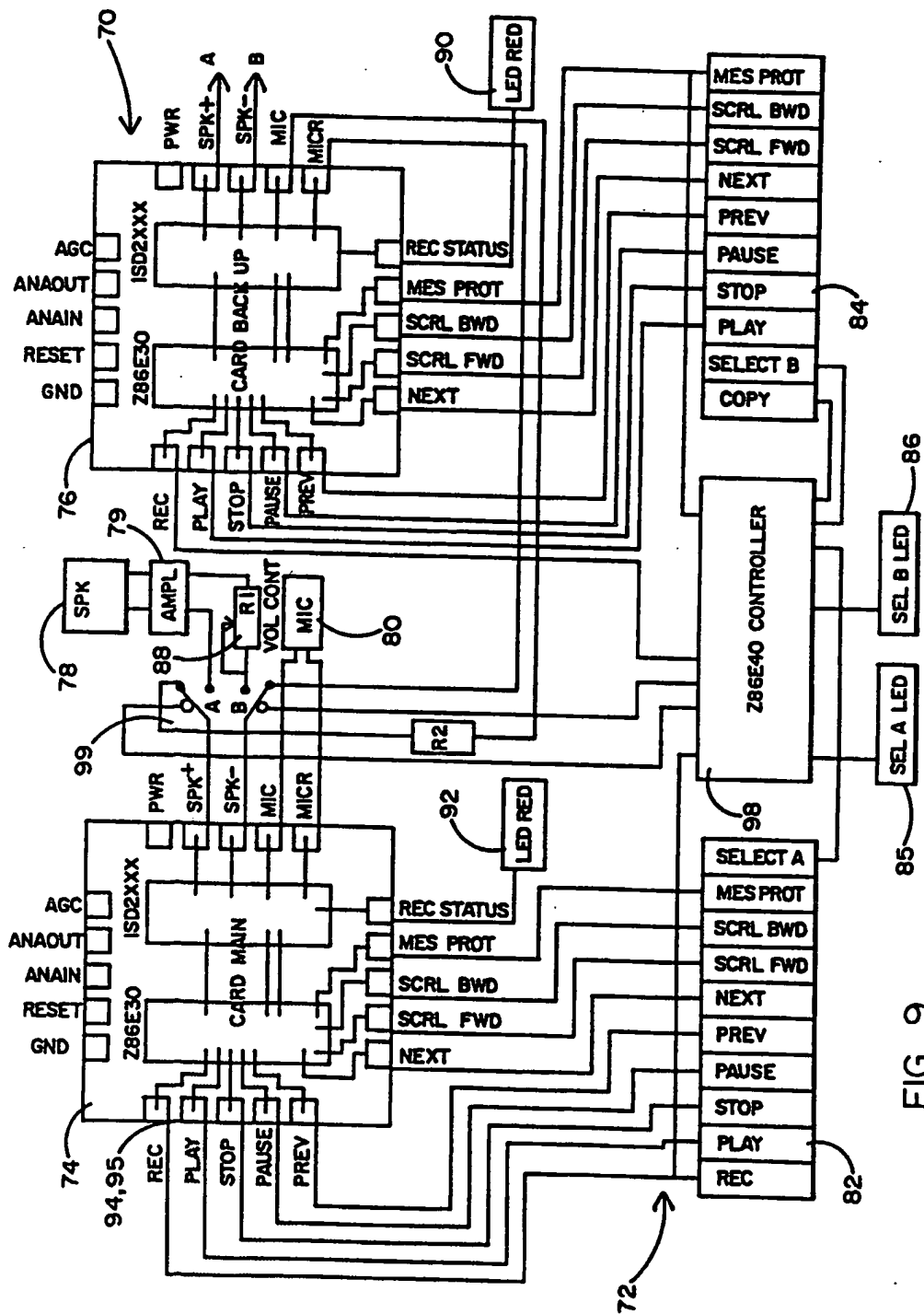


FIG. 9

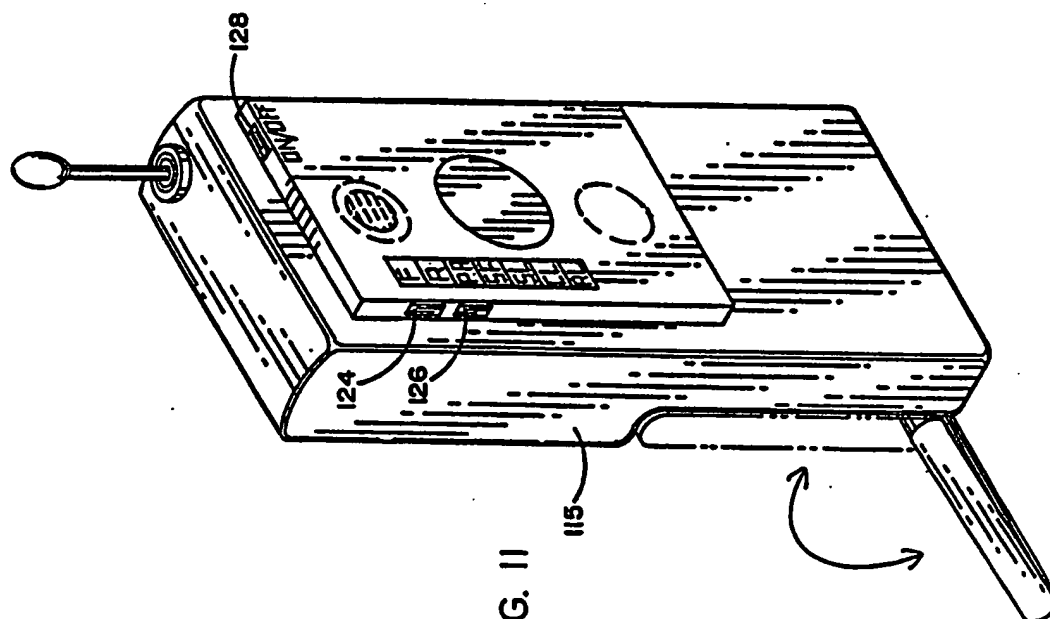


FIG. 11

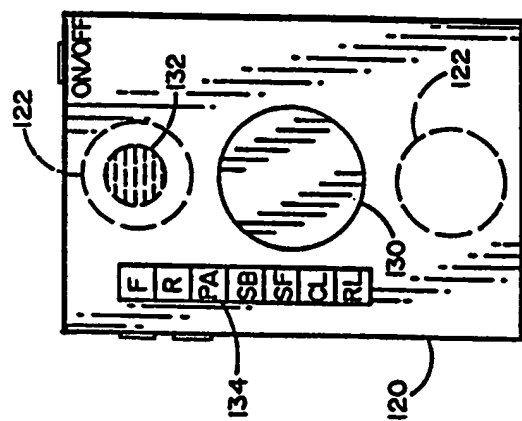


FIG. 10

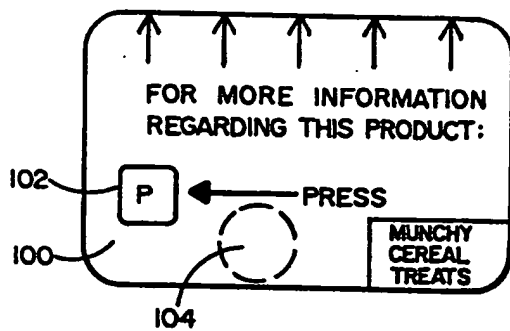


FIG. 12

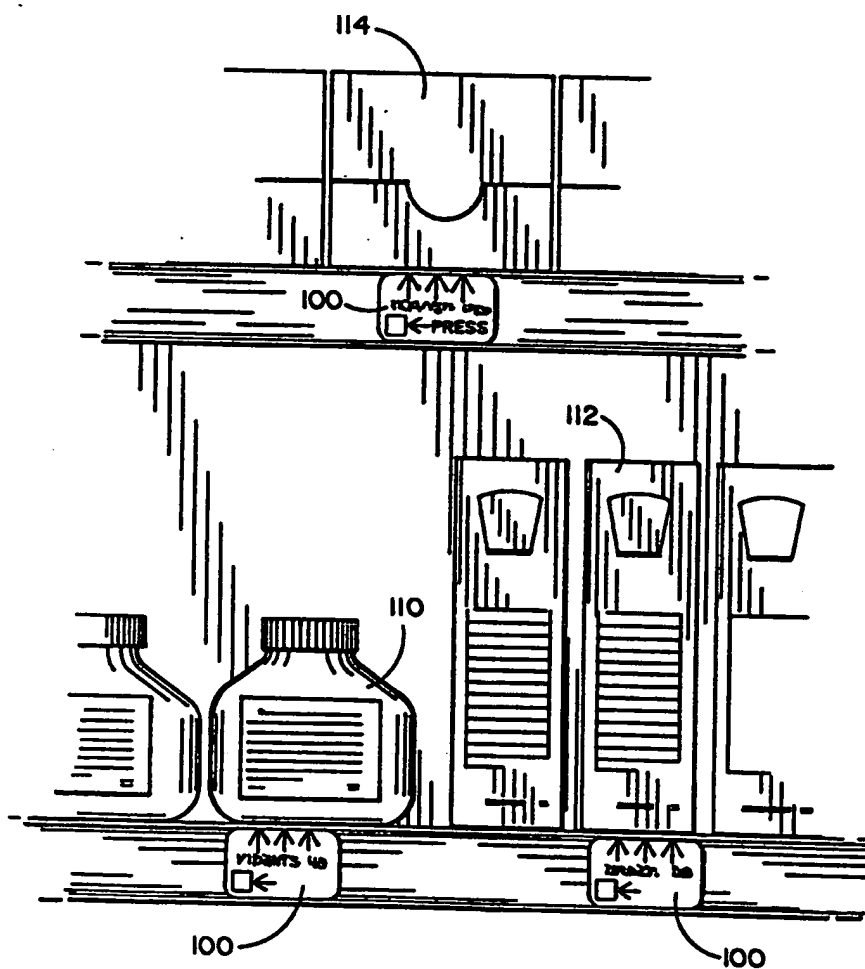


FIG. 13

## INTERNATIONAL SEARCH REPORT

International application No.

PCT/US93/04219

**A. CLASSIFICATION OF SUBJECT MATTER**

IPC(5) : G10L 5/02

US CL : 395/2; 365/230.03

According to International Patent Classification (IPC) or to both national classification and IPC

**B. FIELDS SEARCHED**

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 395/2; 365/230.03; 381/36, 51; 206/232; 369/31, 34

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US, A, 4,318,188 (Hoffmann) 2 March 1982, Figs. 7 & 9, Abstract, col. 1, lines 17-21, col. 9-10.	1-20
Y	US, A, 4,368,988 (Tahara et al.) 18 January 1983, Figs. 2, 3 & 6, Abstract, col. 2, lines 8-14, cols. 3-6, col. 8, line 45-col. 10.	1-20
Y	US, A, 5,045,327 (Tarlow et al.) 3 September 1991, Abstract, Figs. 1-6, col. 3, lines 7-25, col. 4, line 10 - col. 6, line 28.	1-20
Y	US, A, 4,791,741 (Kondo) 20 December 1988, Abstract, Figs. 1 and 6, cols. 1-2.	1-20

☒ Further documents are listed in the continuation of Box C.
 ☐ See patent family annex.

* Special categories of cited documents:	T	later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
*A* document defining the general state of the art which is not considered to be part of particular relevance	X	document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
*E* earlier document published on or after the international filing date	Y	document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
*L* document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	A*	document member of the same patent family
*O* document referring to an oral disclosure, use, exhibition or other means		
*P* document published prior to the international filing date but later than the priority date claimed		

Date of the actual completion of the international search

26 JULY 1993

Date of mailing of the international search report

AUG 26 1993

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DAVID D. KNEPPER

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**PCT/US93/04219**

**International application No.**  
**PCT/US93/04219**

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US, A, 4,698,776 (Shibata) 6 October 1987, Abstract, Figs. 1, 2, 5 & 6.	1-20
Y	US, A, 4,772,873 (Duncan) 20 September 1988, Figs. 1, 3, Abstract.	1-20
Y	DE, 3532259 (Weigl) 12 March 1987, Fig. 1 & Abstract.	1-20